

OSHDP Office of Statewide Health Planning and Development

Hospital Building Safety Board
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***** SPECIAL NOTICE *****

Because of the COVID-19 emergency, this meeting will only be held by teleconference. Committee members and members of the public may fully participate from their own locations.

NOTICE OF PUBLIC MEETING

HOSPITAL BUILDING SAFETY BOARD
Technology and Research Committee

Date:

Thursday, April 29, 2021
9:00 a.m. – 3:00 p.m.

Teleconference Meeting Access:

[HBSB GoToMeeting Technology Committee](#)

Access Code: 667-620-549

For more detailed instructions on how to join via GoToMeeting, see page 3.

Committee Members:

Bruce Rainey, Chair; Michael Foulkes, Vice-Chair; David Bliss; Benjamin Broder*;
Deepak Dandekar; Gary Dunger*; Bert Hurlbut; Eric Johnson*; Roy Lopez;
Bruce Macpherson; Michael O'Connor

OSHDP Staff:

Hussain Bhatia; Joe LaBrie; Diana Scaturro; Jamie Schnick; Richard Tannahill;
Nanci Timmins

OSHDP Director:

Elizabeth Landsberg

FDD Deputy Director:

Paul Coleman

Executive Director:

Ken Yu

*Consulting Member

2. Nurse Call Demonstration Project

Facilitator: Walt Vernon, Mazzetti (or designee)

- The Facilities Guidelines Institute is trending away from planned changes to nurse call requirements currently within UL1069
- Discussion will be on a parallel system to code-minimum nurse call systems and the need for a demonstration project on the reliability and effectiveness of a parallel system to prove the concept
- Discussion and public input

3. Microgrids in Healthcare

Facilitator: Jamie Schnick, OSHPD (or designee)

- OSHPD task force and path forward for implementation of microgrids in California healthcare
- Discussion and public input

California Healthcare Microgrids

Jamie Schnick
OSHDP – Sr Electrical Engineer
4-29-2021

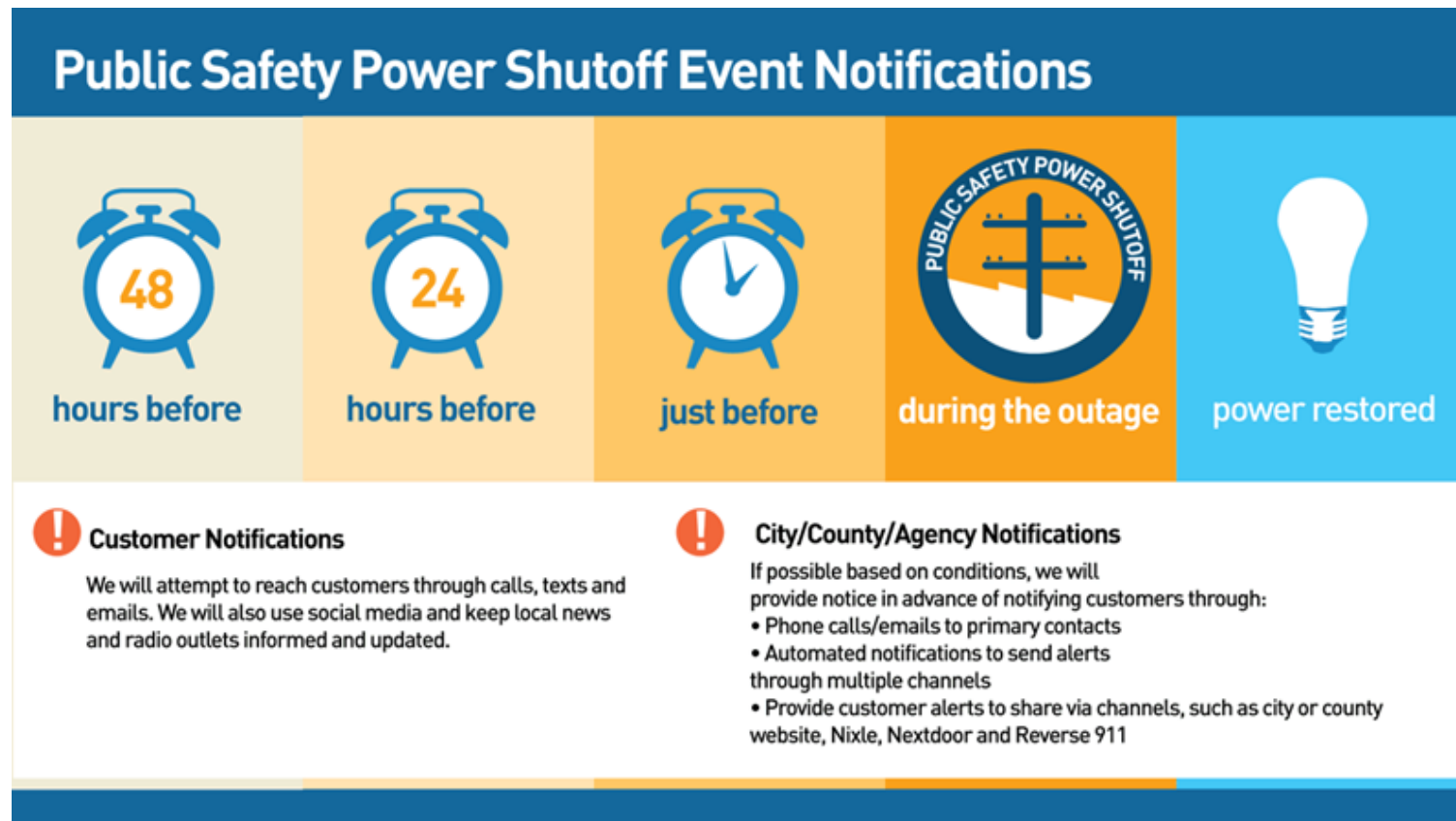
WHAT IS A MICROGRID?

Definition – Department of Energy:

- A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. Microgrids can connect and disconnect from the “utility electric” grid to enable them to operate in both grid-connected or island mode.

WHY MICROGRIDS NOW?

- Reliability – PSPS are now common
- Clean Power – Reduced Greenhouse gas (GHG) emissions



OSHPD MICROGRID TASK FORCE

Created to work with Owners/Designers/Builders/Vendors to help incorporate Healthcare Microgrids in California.



Schnick, Jamie@OSHPD
Senior Electrical Engineer



Dickey, Chris@OSHPD
Senior Electrical Engineer



Gow, Bill@OSHPD
Senior Electrical Engineer



Mason, David@OSHPD
Senior Mechanical Engineer



Navarro, Diana@OSHPD
Supervisor, Health Facilities Review



Tannahill, Richard@OSHPD
Supervisor



Sumer, Ali@OSHPD
Supervisor



Timmins, Nanci@OSHPD
Chief Fire & Life Safety Officer HFC



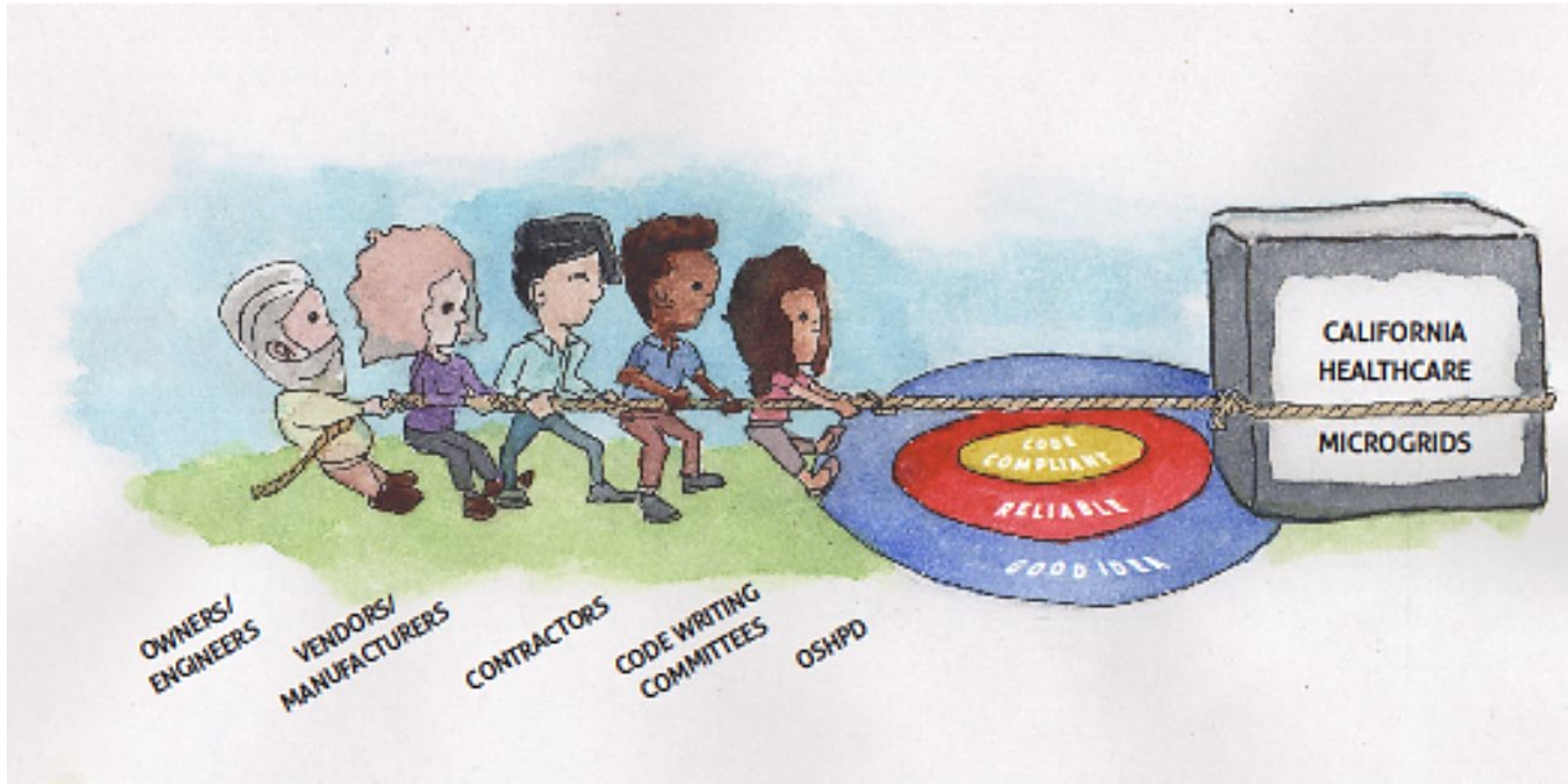
Coleman, Paul@OSHPD
C.E.A.

THE MISSION

To help with the process of delivering Microgrids as Emergency Power Sources (EPS's) for California Healthcare Facilities that are:

- Code compliant
- At least as reliable as the current go to EPS's - Diesel Generators.

GROUP EFFORT



NORMAL POWER

- Microgrids can be implemented/installed now for **Normal Power** in a straightforward code compliant manner - OSHPD will need to verify that the microgrid(s) will fail safely.
- Benefits:
 - Energy Reliability/Resilience
 - GHG Emissions reductions
 - Operational Cost Benefits



EMERGENCY POWER

- Still some details to be worked out for **Emergency Power** solutions
- Additional benefits:
 - Cost avoidance
 - Space savings
 - Enhanced GHG emissions





EMERGENCY POWER - CHALLENGES

- CMS – Centers for Medicare & Medicaid Services
- Codes
 - Configuration/Allowable sources
 - Seismic Compliance
 - On-site Fuel Storage
- Product availability

CMS

Reimbursement contingent on design compliance

- CMS adopts 2012 NFPA 99 and 2012 NFPA 101
- 2012 NFPA 99 states “Type 1, 2, &3 Essential Electrical System Power Sources Shall be Classified as type 10, Class x Level 2 generator sets per NFPA 110”
 - 2012 NFPA 99 and NFPA 101 adopts 2010 NFPA 110
- Nanci Timmins (Chief Fire and Life Safety Officer) has contacted and shared the Healthcare Microgrid White Paper with CMS, with the request for them to allow alternate green energy producers to be acceptable EPS's.

CODES – CONFIGURATIONS/SOURCES

Current Requirements

(2019 CEC/2018 NFPA 99/2016 NFPA 110)

- CEC 517.30 requires (2) Independent Power Sources (normal and emergency) Generators and Fuel Cells allowed as EPS
- CEC 700.10 Wiring from an emergency source shall be kept entirely independent of all other wiring and equipment
- CEC 700.12 lists: Batteries, Generators, UPS, Fuel Cells and Unit Batteries as sources of Emergency Power (not for hospitals)
- NFPA 99 allows either Generator, Batteries or Fuel Cell as EPS

CODES – CONFIGURATIONS/SOURCES

Upcoming Changes (adoption date 1/1/2023)

(2022 CEC/2021 NFPA 99/2019 NFPA 110)

no change

- CEC 517.30 requires (2) Independent Power Sources
- CEC 700.10 Wiring from an emergency source shall be kept entirely independent

changes

- CEC will allow generators, batteries and fuel cells as EPS's
- NFPA 99 will allow generator, batteries, fuel cells and Microgrids as EPS's
- NFPA 99 states that Microgrids can be used as Emergency Power Sources if
“Designed with sufficient reliability to provide effective facility operation consistent with the facilities emergency operations plan.”

CODES - SEISMIC CERTIFICATION

OSP's and seismic bracing of the microgrid components will be required if part of the EPS. This would apply to applicable “parts and pieces” of the following on-site power producers and controllers:

- Fuel Cells
- Photo Voltaics
- Battery Storage Systems
- CoGen equipment
- Natural Gas Turbines
- Natural Gas Reciprocating Engines
- Etc...

CODES - FUEL STORAGE

On-Site Fuel Requirements

- OSHPD 1 (Hospitals) – 96 hrs per NFPA 110
- OSHPD 2 (Skilled Nursing Facilities)- 6 hrs if more than 7 beds
 - SB 1207 would extend to SNF back-up requirements to 96 hrs
- OSHPD 3 (Clinics) Ambulatory Surgery Clinics - 4 hrs otherwise 90 min
- OSHPD 4 (Correctional Facilities) - 6 hrs if more than 7 beds
- OSHPD 5 (Psychiatric Facilities) - 6 hrs if more than 7 beds

WHAT HAVE WE SEEN TO DATE

- 
- Potential Microgrid Project Meetings
 - Vendor Presentations
 - Exhibition Project

MEETINGS

- Discussions about various approaches to microgrids that might turn into projects.
 - SNF's
 - Hospitals

PRESENTATIONS

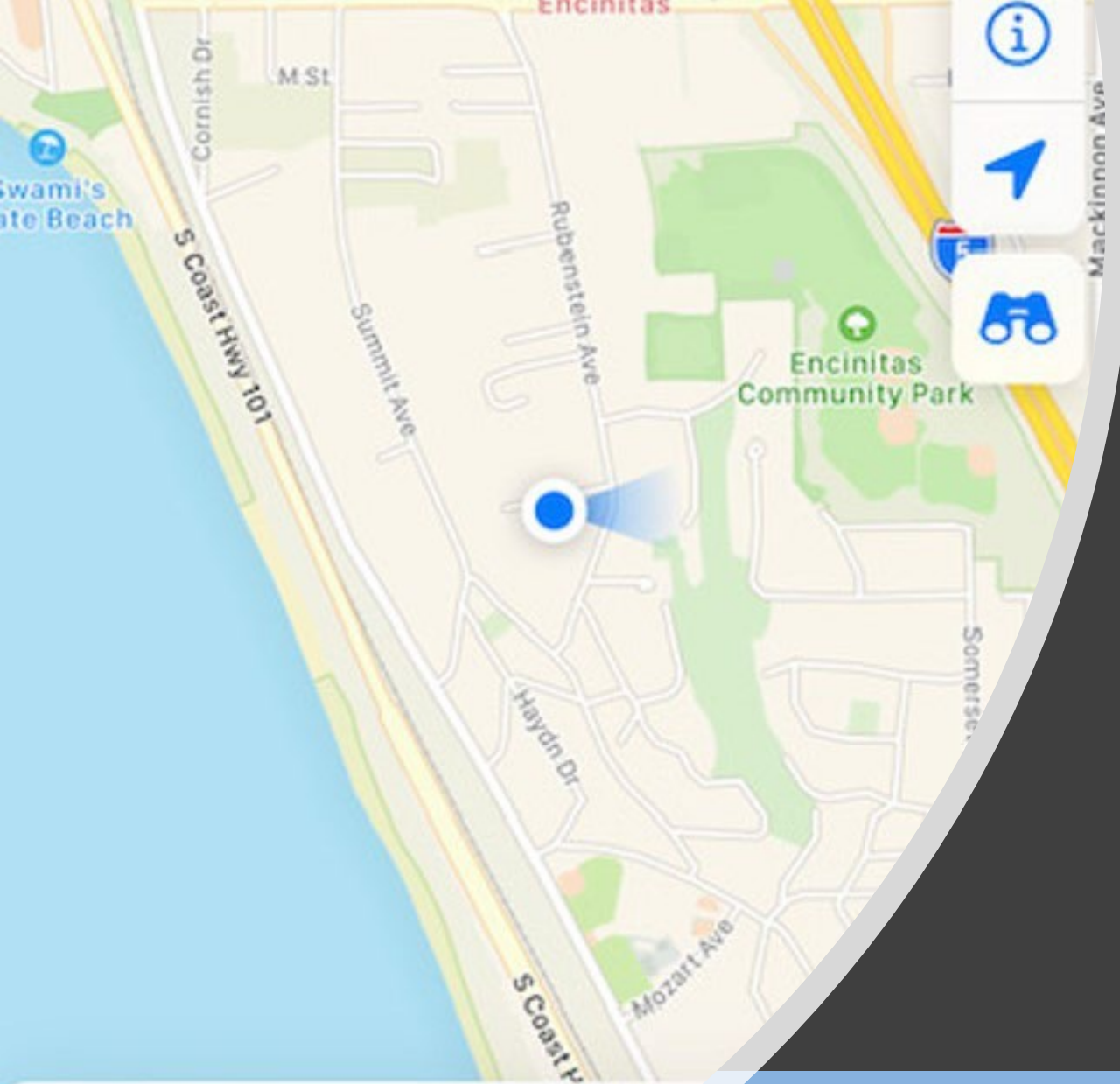
- Reciprocating engines using recycled natural gas
 - Proprietary engineered solution
 - Success in backing up hospitals in Texas
- New UL Listing for Microgrid Controllers UL 6200
 - 25 products listed
 - Has references for emergency use

EXHIBITION PROJECT

Existing Hospital in Ontario – Microgrid as alternate normal and emergency source

Alternate Method Of Compliance (AMOC)

- Microgrid elements (fuel cells, batteries, and photovoltaic cells) do not have OSP's and the proposed scope of change is to allow the connection of these components to the essential power system without seismic certification as required by CBC Section 1705.13.3.1 or CEC Article 700.12(B)(2) requiring on-site fuel storage.



Where do we go from here?

Q Search for a place c

PROJECTS

- Microgrids that parallel normal service – approvable
 - Existing buildings
 - New construction
- Microgrids for emergency power sources - tbd
 - Clinics
 - SNF's
 - Correctional Facilities
 - Psychiatric Hospitals
 - Hospitals



WHATS ON THE HORIZON?

Address Microgrid as emergency source challenges

- CMS
 - Continue Discussions
- Changing Codes
 - Provide input
 - Develop interpretations
- Seismic Compliance
 - OSP's needed
- On-site Fuel Storage
 - OSHPD working on demand factors

Look into Commissioning and annual testing requirements for healthcare microgrids used for EPS's



QUESTIONS



4. Power Over Ethernet (POE) Lighting Solutions

Facilitator: Becky Clift, TK1SC, and Mitch Hefter, Signify (or designees)

- Current code issues with implementation of POE
- Code changes upcoming through future code cycles
- Discussion and public input



Power over Ethernet & Codes

April 2021

Mitch Hefter, LC, NEC Panel 15
- Sr. Systems Engineer
Signify

Becky Clift, RCDD / LEED AP
- Principal
tk1sc



Agenda

Quick Review of PoE

Code History

Upcoming Code Changes

Solutions for Essential Electrical Systems

Quick Review - Power over Ethernet

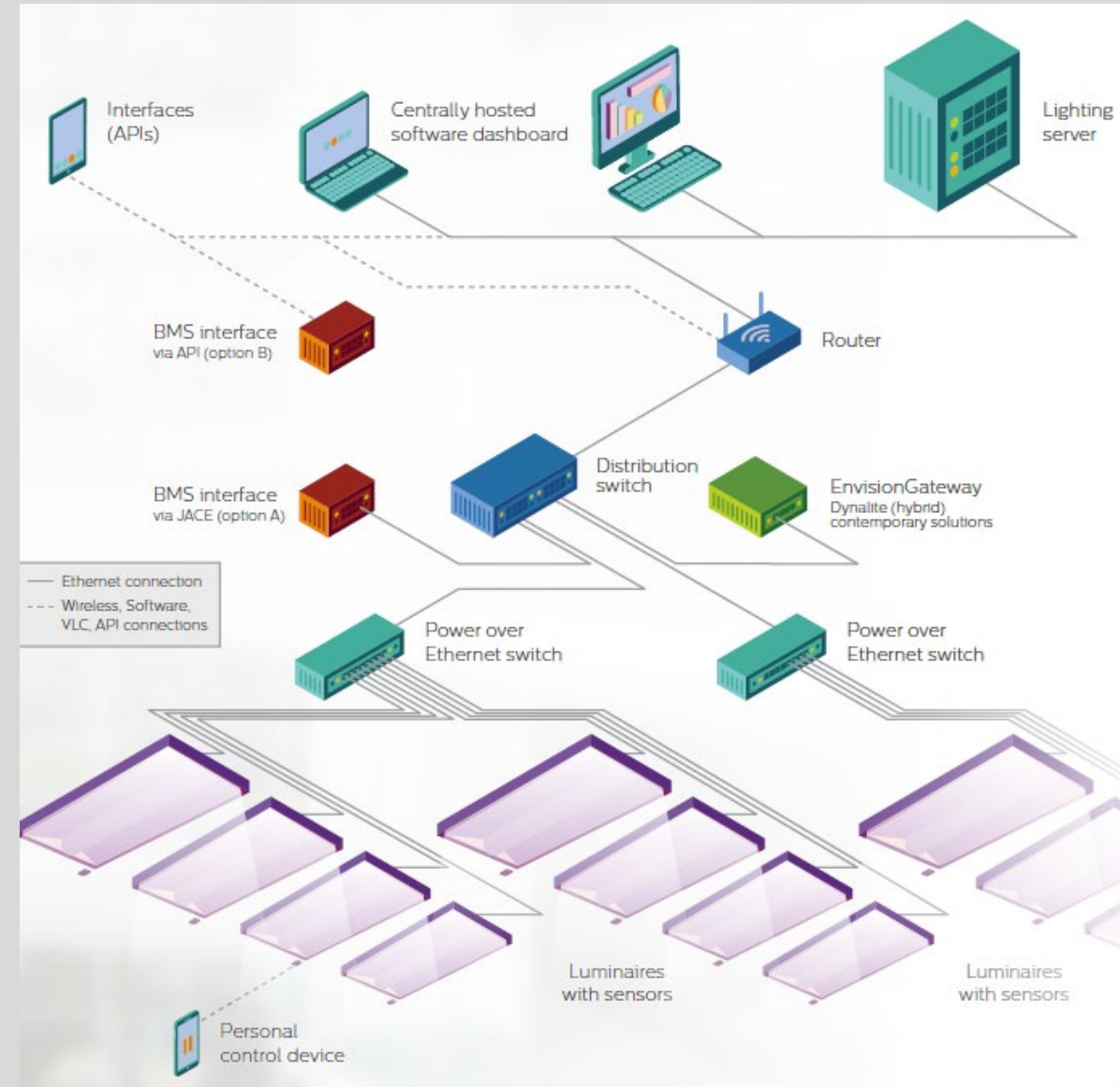
PoE Combines data and low power to devices on the same cable, using the same structured cabling system as “traditional” Category Cable based Ethernet

- Original version of PoE : 15.4W* (IEEE 802.3af)
- Next generation – PoE+ : 30W* (IEEE 802.3at)
- Proprietary solution – Cisco’s UPOE : 60W*
- Current generation – PoE++ : up to 90W* (IEEE 802.3bt)

* Power values at the source

“Detection is the most important function in a PoE system. It determines if the remote equipment connected to a PSE (Power Sourcing Equipment - Switch) is capable of receiving power (in other words, it determines if it is a PD (Powered Device)).”¹

Passive PoE – which is not PoE – is DC Power carried on Ethernet cabling, but no “smarts” (detection and classification), no standardization, no inherent current/power limiting.



¹ Yseboodt, Abramson (December 2019), “Overview of 802.3bt - Power over Ethernet standard” https://ethernetalliance.org/wp-content/uploads/2019/12/WP_EA_Overview8023bt_V2p1_FINAL.pdf

IoT Use Case Examples:

Intelligent IoT Lighting Solution that enables you to create a smart commercial space.



Lighting management

- Central control panel
 - Scheduling
 - Light control API



Space management

- Occupancy dashboard
 - Occupancy reports
- API for occupancy data
- People counting data
- Space management app



Lighting asset management

- Maintenance information
 - Alarms & diagnostics
- Automatic notifications
- Automated emergency testing
- API for alarms & diagnostics



Indoor navigation

- Personal control based on visible light communication
 - Indoor positioning SDK for 3rd party app integration
- Indoor navigation app (kiosk)



Energy optimization

- Automatic lighting behavior
 - Daylight harvesting
- Energy dashboard
- Energy reports
- Energy analytics
- Integration option with HVAC/BMS
- API for energy data



Bio-adaptive lighting

- Tunable white technology
- Programming day rhythms
- Activity focused light recipes



Scene management

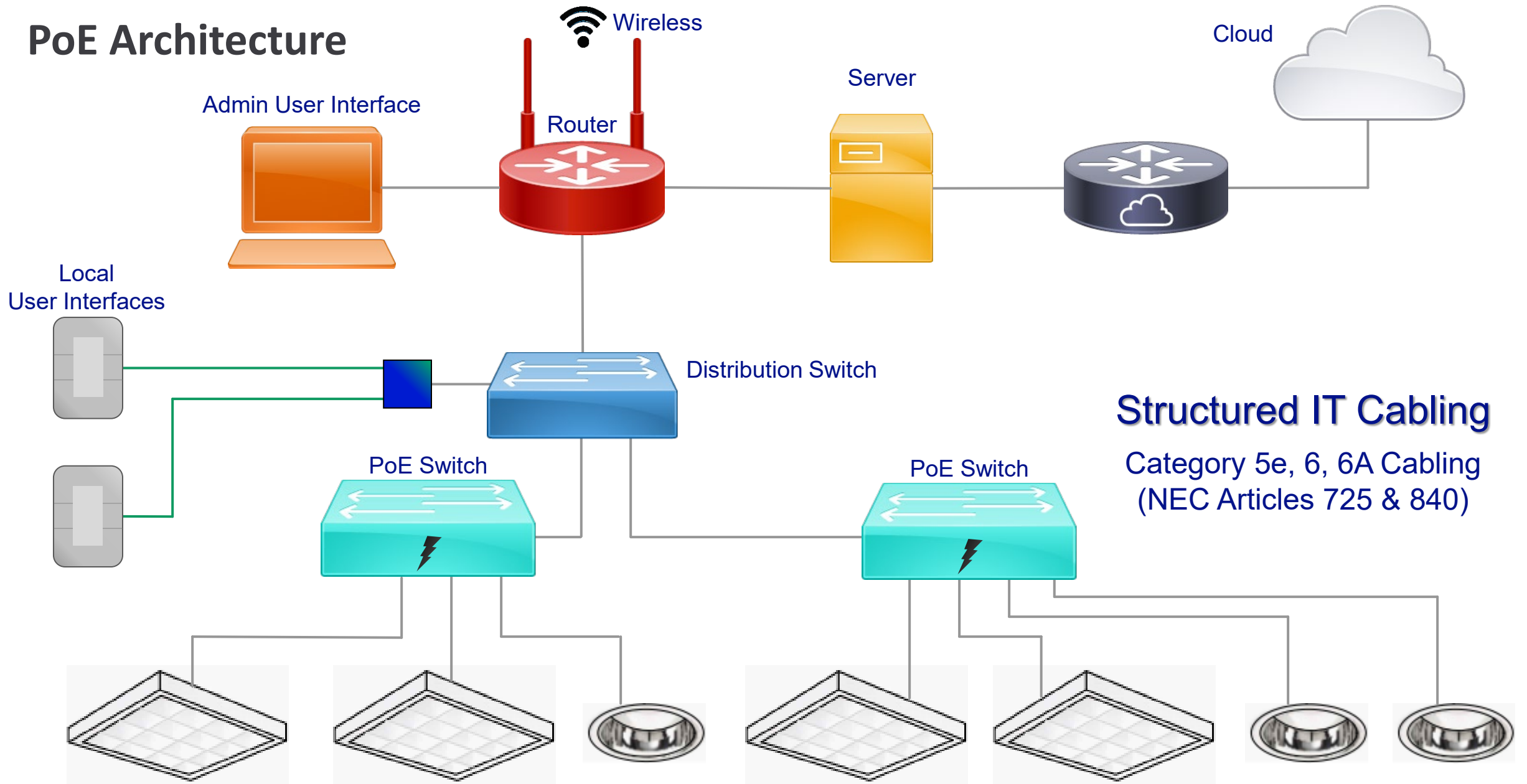
- Fully customizable scenes and behaviors
 - Smartphone personal control app using visible light communication
- Web based control for tenants
- Light control API based on scenes



Environmental monitoring

- Temperature/humidity monitoring
- API for integration with HVAC/BMS

PoE Architecture

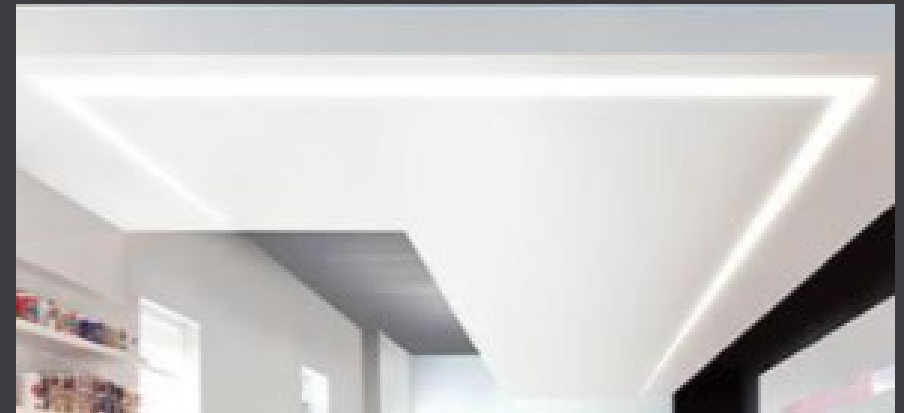
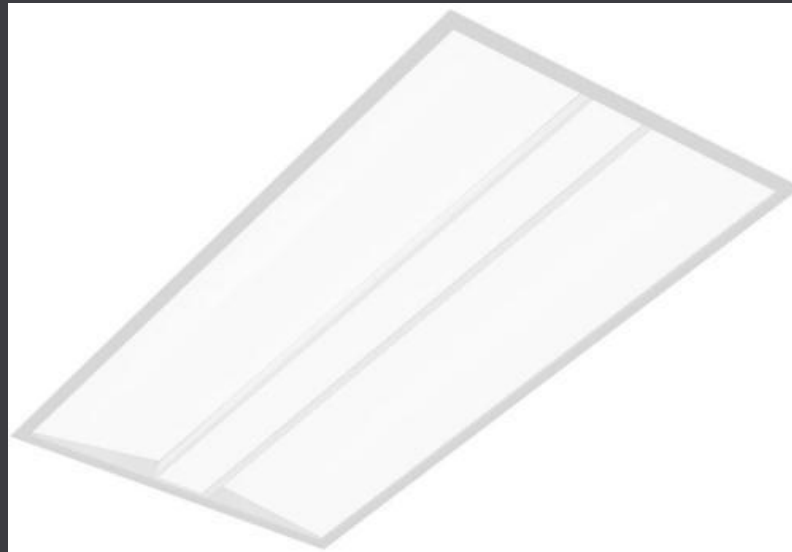




Hardware

PoE Luminaires

- Variety of form factors
- Lumen output
- Color temperatures (static & adjustable)
- Tunable White option has two output channels; vary cool & warm white channels independently



Electrical Code

Ethernet covered in Chapter 8

In 2017, the NEC implemented changes to address the growing use and power levels for PoE.

PoE addressed specifically in:

725.144 Transmission of Power and Data

840.160 Powering Circuits.

The term PoE does not specifically appear except in an exception – but is described as the transmission of power and data and 4-pair communications cables

The exception does not appear in the CEC

2017 CEC

Part VI. Premises Powering of Communications Equipment over Communications Cables

840.160 Powering Circuits. Communications cables, in addition to carrying the communications circuit, shall also be

725.144 Transmission of Power and Data. The requirements of 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. The requirements of Parts I and III of Article 725 and 300.11 shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

Informational No. 1: One example of the use of cables that transmit power and data is the connection of closed-circuit TV cameras (CCTV).

Informational Note No. 2: The 8P8C connector is in widespread use with powered communications systems. These

725.144 Transmission of Power and Data.

The requirements of **725.144(A) and (B)** shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. The requirements of Parts I and III of Article **725** and **300.11** shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

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Informational Note No. 2: The 8P8C connector is in widespread use with powered communications systems. These connectors are typically rated at 1.3 amperes maximum.

2017 NEC:

840.160 Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. Installations of listed communications cables shall comply with [725.144](#) where listed communications cables are used in place of Class 2 and Class 3 cables.

Exception: Compliance with [725.144](#) shall not be required for installations of listed 4-pair communications cables where the nominal current does not exceed 0.3 amperes in any conductor.

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Type	Standards	Maximum Current Per Pair	Number of Energized Pairs	Power at Source	Power at Device
PoE	IEEE 802.3af (802.3at Type 1)	350 mA	2	15.4 W	13 W
PoE+	IEEE 802.3at Type 2	600 mA	2	30 W	25.5 W
PoE++ (4PPoE)	IEEE 802.3bt Type 3	600 mA	4	60 W	51 W
PoE++ (4PPoE)	IEEE 802.3bt Type 4	960 mA	4	99 W	71.3 W

NEC 2017
not a concern



NEC 2017
imposes new
requirements



2017 NEC / 2019 CEC

AWG	Number of 4-Pair Cables in a Bundle																				
	1			2–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1	1	1	1	1	1	0.7	0.8	1	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2	2	2	1	1.4	1.6	0.8	1	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3	3	3	1.4	1.8	2.1	1	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.8	0.9	0.5	0.6	0.7

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.



Type	Standards	Maximum Current Per Pair	Number of Energized Pairs	Power at Source	Power at Device
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2020 NEC

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	1–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	NA	NA	NA
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.28	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

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2017 NEC / 2019 CEC

517.31(C)(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected. Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of [517.13\(A\)](#) and (B). Only the following wiring methods shall be permitted:

- (1) Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.
- (2) Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.
- (3) Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:
 - a. Where used in listed prefabricated medical headwalls
 - b. In listed office furnishings
 - c. Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage
 - d. Where necessary for flexible connection to equipment
 - e. For equipment that requires a flexible connection due to movement, vibration, or operation
 - f. Luminaires installed in rigid ceiling structures where there is no access above the ceiling space after the luminaire is installed
 - g. [\[OSHPD 1,2,3 \(surgery clinics\), 4, & 5\]](#) Where necessary to allow relative movement between adjacent buildings
- (4) Flexible power cords of appliances or other utilization equipment connected to the emergency system.
- (5) Cables for Class 2 or Class 3 systems permitted by Part VI of this Article, with or without raceways.

Informational Note: See [517.13](#) for additional grounding requirements in patient care areas.

2020 NEC / Basis for 2022 CEC

517.31(C)(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected by raceways. [\[99:6.7.5.2.2\]](#) Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of [517.13\(A\)](#) and (B) and [250.118](#). Only the following wiring methods shall be permitted:

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CEC

2020 NEC / Basis for 2022 CEC

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2023 First Draft

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Informational Note: See [517.13](#) for additional grounding requirements in patient care areas.

CEC

2020 (same as 2017 NEC / 2019 CEC)

Part VI. Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal

517.80 Patient Care Spaces.

Equivalent insulation and isolation to that required for the electrical distribution systems in patient care areas shall be provided for communications, signaling systems, data system circuits, fire alarm systems, and systems less than 120 volts, nominal.

Class 2 and Class 3 signaling and communications systems and power-limited fire alarm systems shall not be required to comply with the grounding requirements of 517.13, to comply with the mechanical protection requirements of 517.31(C)(3)(5), or to be enclosed in raceways, unless otherwise specified by Chapter 7 or 8.

Secondary circuits of transformer-powered communications or signaling systems shall not be required to be enclosed in raceways unless otherwise specified by Chapters 7 or 8. [99:6.7.2.3.7]

2023 First Draft

Part VI. Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal

517.80 Patient Care Spaces.

Equivalent insulation and isolation to that required for the electrical distribution systems in patient care areas shall be provided for communications, signaling systems, data system circuits, fire alarm systems, and systems less than 120 volts, nominal.

Class 2 and Class 3 signaling and communications systems, Class 2 circuits that transmit power and data to a powered device, and power-limited fire alarm systems shall not be required to comply with the grounding requirements of 517.13, to comply with the mechanical protection requirements of 517.31(C)(3)(5), or to be enclosed in raceways, unless otherwise specified by Chapter 7 or 8.

Secondary circuits of transformer-powered communications or signaling systems shall not be required to be enclosed in raceways unless otherwise specified by Chapters 7 or 8. [99:6.4.2.2.6.6 6.7.2.2.7]

Informational Note: See ANSI C137.3-2017, American National Standard for Lighting Systems – Minimum Requirements for Installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems, for information on installation of cables for PoE lighting systems.

Key parts of Substantiation for adding clarifying language to 517.80

A recent [NFPA] staff interpretation of this section essentially stated that since the words “Power over Ethernet” aren’t in the clause, Power over Ethernet (PoE) is not covered by this exception to the grounding and mechanical requirements of 517.31(C)(3)(5). [However] – Power over Ethernet is a Power-Limited system that provides signaling and communications – and it also delivers power to devices such as Wireless Access Points and Lighting. It falls under the requirements/restrictions of Class 2. While the term “Power over Ethernet” is not defined directly in the NEC, it is referred to under its basic definition of circuits that “transmit power and data to a powered device.”

- and -

Additionally, 725.144 [Transmission of Power & Data] under Part III of Article 725 [Class 2 and Class 3 circuits] specifically addresses “Class 2 and Class 3 circuits that transmit power and data to a powered device” – i.e., Power Over Ethernet.

2023 First Draft

700.11 Wiring, Class-2-Powered Emergency Lighting Systems.

(A) General.

Line voltage supply wiring and installation of Class 2 emergency lighting control devices shall comply with 700.10. Class 2 emergency circuits shall comply with 700.11(B) through (D).

(B) Identification.

Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:

- (1) All boxes and enclosures for Class 2 emergency circuits shall be permanently marked as a component of an emergency circuit or system.
- (2) Where boxes or enclosures are not encountered, exposed cable, cable tray, or raceways systems shall be permanently marked to be identified as a component of an emergency circuit or system, within 3 m (1 ft) of each connector and at intervals not to exceed 7.6 m (25 ft).

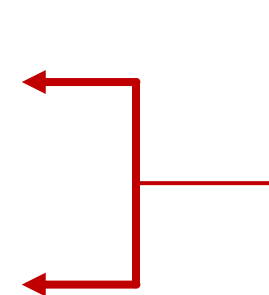
(C) Separation of Circuits.

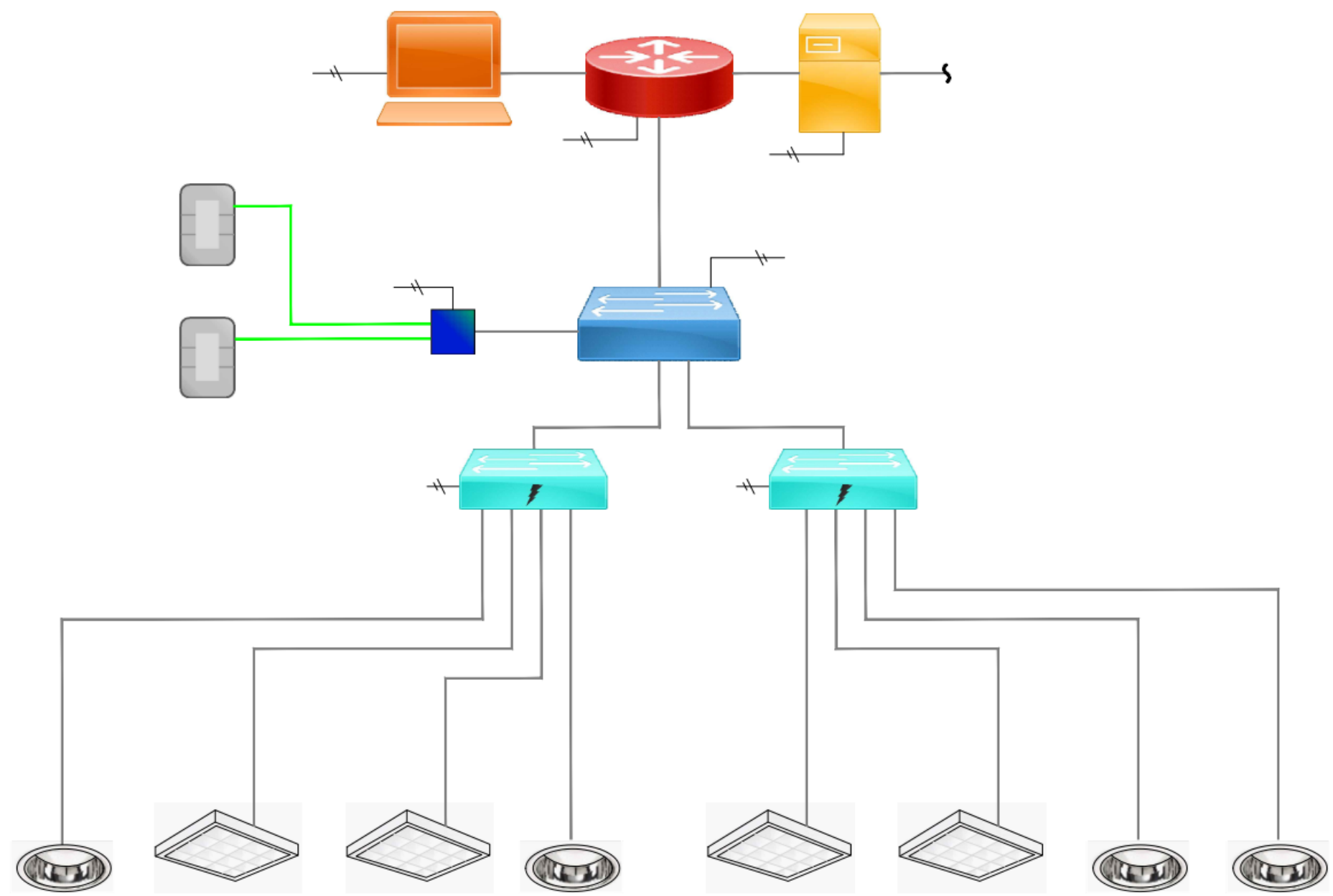
Class 2 emergency circuits shall be wired in a listed, jacketed cable or with one of the wiring methods of Chapter 3. Class 2 emergency circuits shall be separated from nonemergency Class 2 circuits. Separation from other circuits shall comply with 725.136.

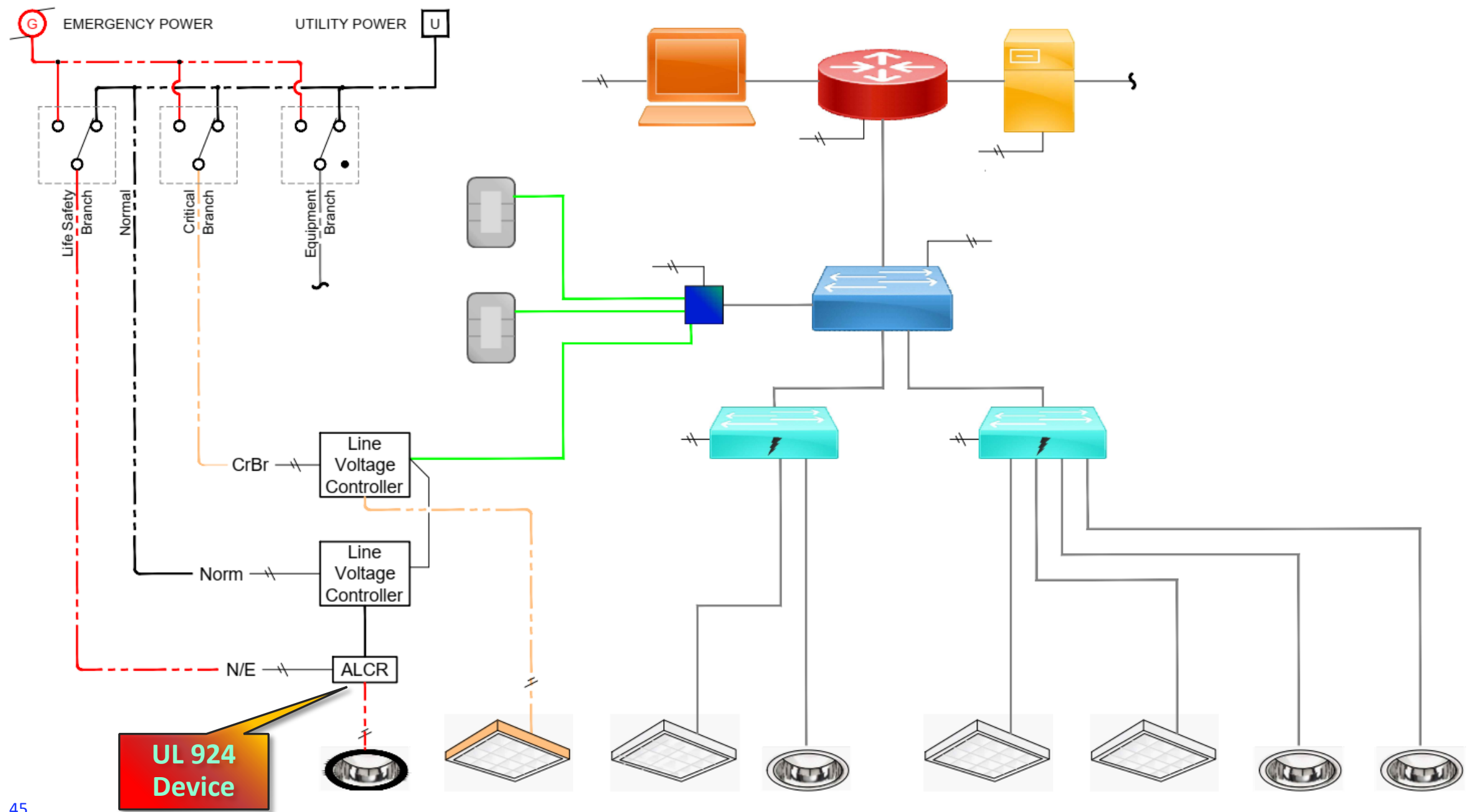
(D) Protection.

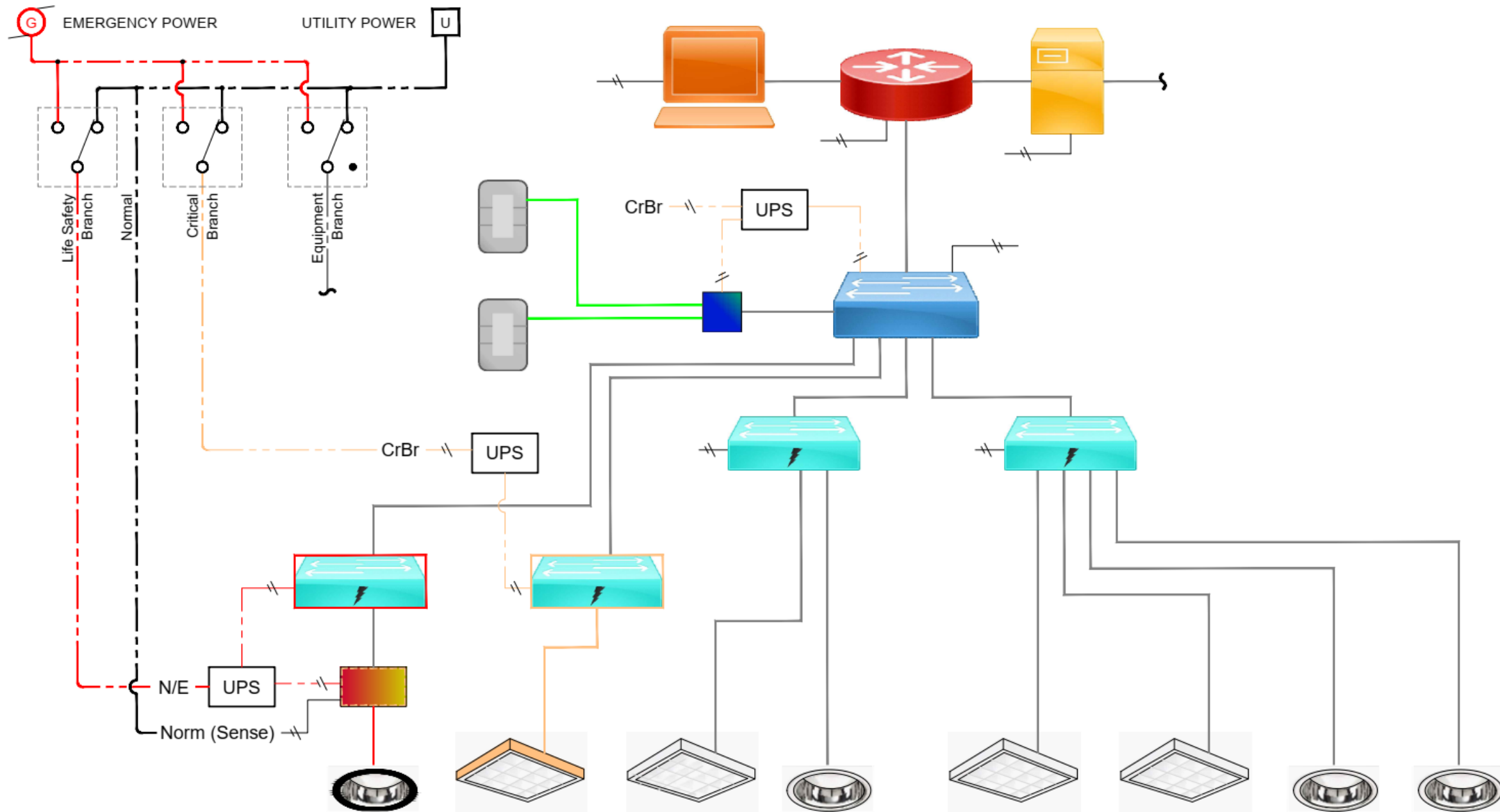
Wiring shall comply with the requirements of 300.4 and be installed in a raceway, armored or metal-clad cable, or cable tray.

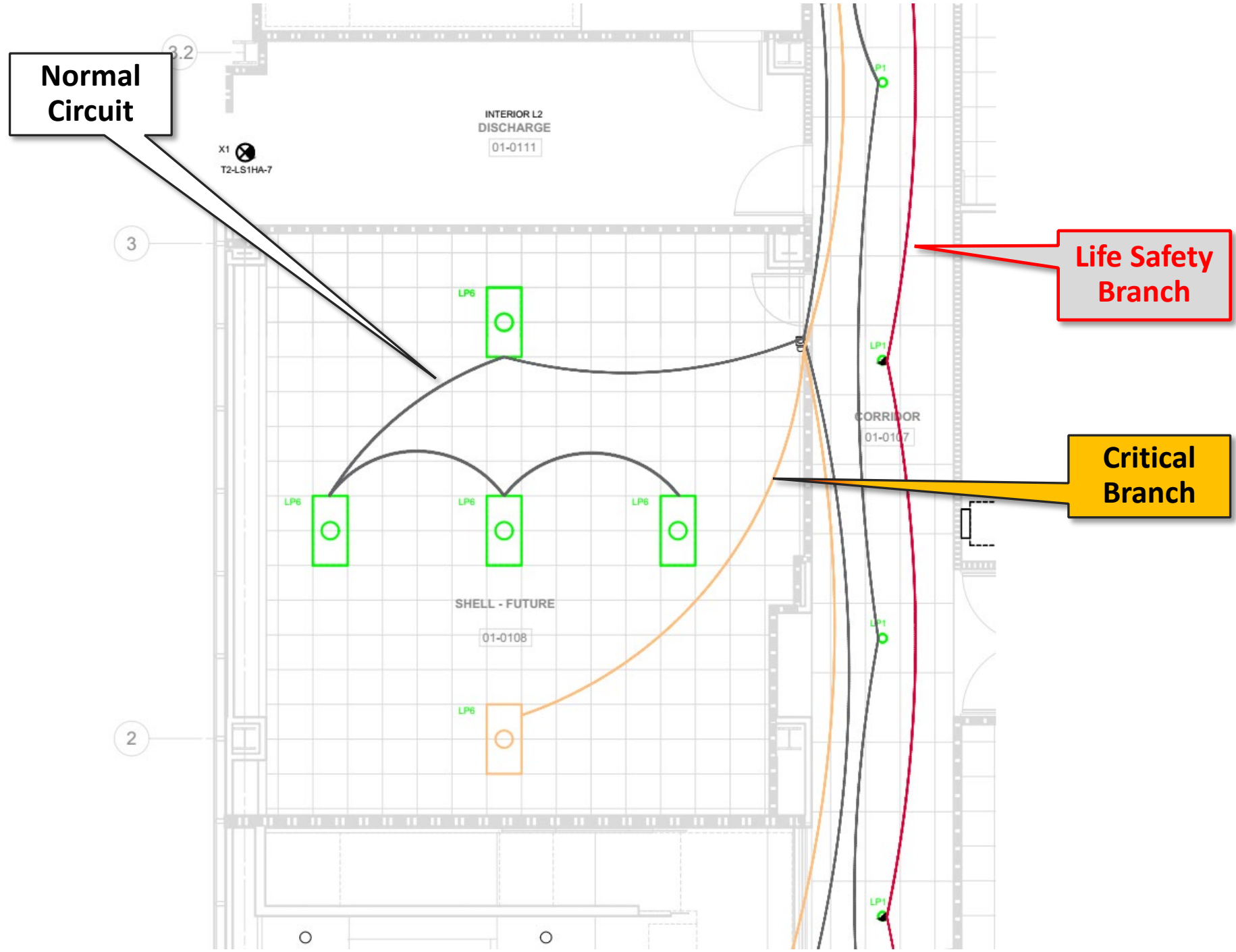
Conflict between (C) & (D) – original proposal included '*Where subject to physical damage*' at the beginning of (D). Restoring that from the proposal would resolve the conflict and make the section consistent.

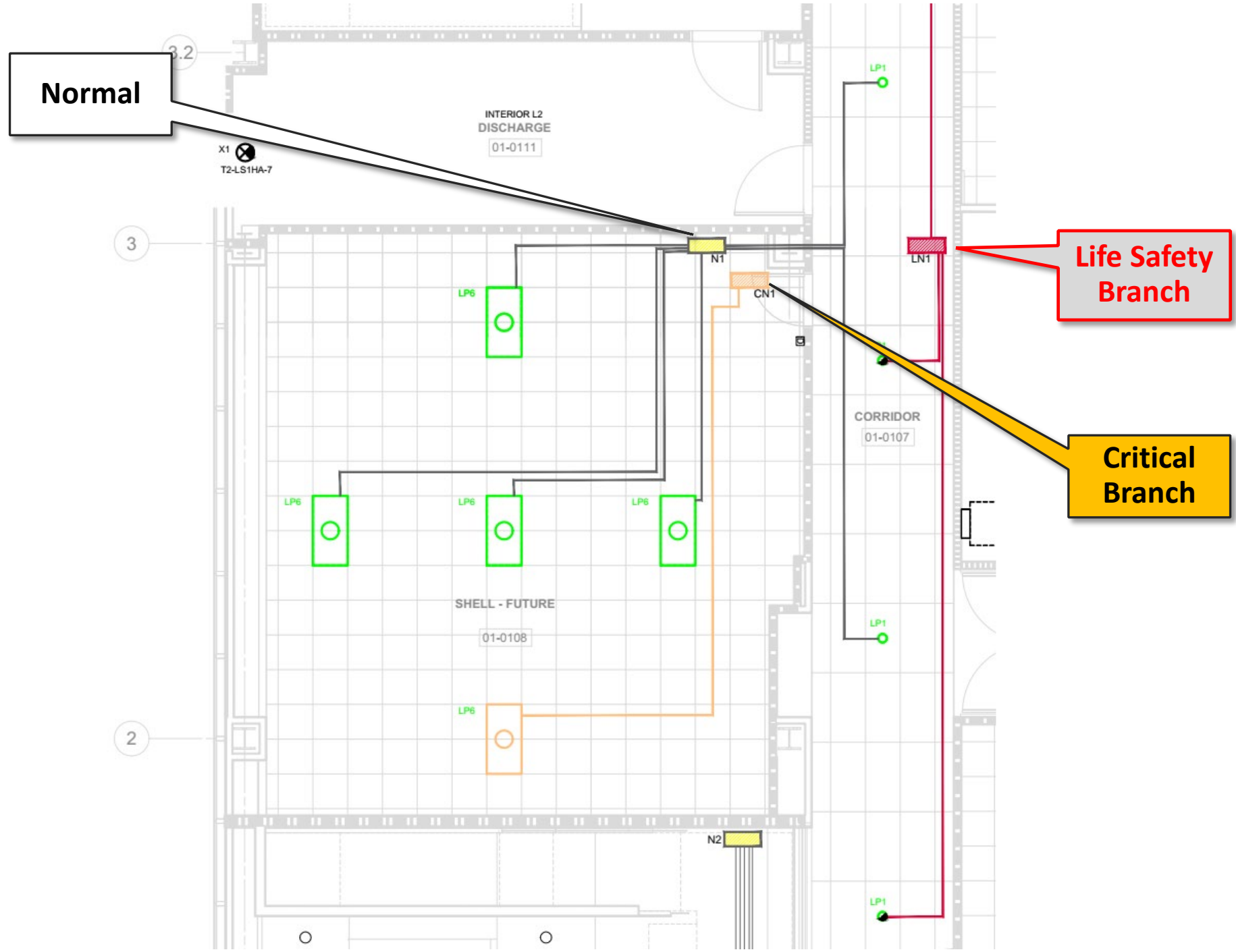














THANK YOU !

Power over Ethernet & Codes

5. Wireless Coverage in Stairwells and Elevators

Facilitator: Bill Bundy, Trusted Wireless (or designees)

- Issues in implementation of wireless connectivity in stairwells and elevator shafts for clinicians
- Traffic segregation techniques for guest access to create a safer environment for patient care requirements
- Discussion and public input

Wi-Fi Coverage Issues in Stairwells and Elevators

California Hospital Building Safety Board
Technology and Research Committee

April 29, 2021

Presentation by Mitchell Ross, CTO



The Need

- Today, Wi-Fi is used for both voice communications and data transmission
 - Hospitals use cases include clinician and non-clinician communications as well as patient monitoring data
- A stairwell is likely to be used little, yet when in use during an emergency, it is a time when people are also most likely need communication to summon help or directions, and data access for information related to the danger
- An elevator is likely to be used a lot, especially with clinicians and patients being transported between floors. It is highly likely that both staff and patients need access to communications and data transport at nearly all times
- Wi-Fi in these areas correctly implemented enhances safety of all within building

The RF Difficulties

- The RF power that the least capable device can transmit at the highest frequency must control, not the AP potential max power
- Stairwell and elevator shaft wall materials, designed for safety, inhibit the Wi-Fi signal to a great extent – concrete wall is 15 dB attenuation at 5 GHz (factor of 32x)
- Stairwell coverage needs to be both up and down each flight – needs proper antenna orientation
- Elevator moving cab
 - Is close approximation of Faraday cage
 - Channel planning issues to APs on floors outside and between shafts and at elevator lobbies

The Code Difficulties

- Electrical and fire codes are designed to limit dangers in stairwell and elevator shafts
 - Codes limit what can be placed in stairwell and elevator shafts
 - Codes limit what can be placed in Elevators
 - Often designs dating from days of incandescent lighting with hot filaments should today (but do not) consider modern solid state equipment
- Local jurisdictions interpret codes differently
- Need for a common code that supplements these codes ...
 - Permits Wi-Fi APs within these use cases for safety and security reasons
 - Provides regulations as to how Wi-Fi is specifically designed for these use cases

Design Issues Common to Both Use Cases

- Client transmit power levels are usually much less than what an AP can provide and should govern the design
 - The end use device with the weakest signal at the highest frequency must be the basis for the design
- Design needs to specify both an SNR and absolute signal level goal
- Higher frequencies require unique design separate from lower frequencies
- Note: Trust requires 100% verification after installation / configuration

Stairwell Wi-Fi Design

- AP power appropriate for space and distances being covered
- Channel planning to not cause interference or roaming issues with respect to APs in areas adjacent to stairwell
- Placed on a landing wall with antenna orientation correctly set to send signal up one flight, down the other
 - AP antenna to have clear line of sight to a height of 42-54" above the floor at the landing above and below.

Elevator Wi-Fi Design

- Ethernet and 120v power to the cab
 - Trailing cable issues – code and physics
- Attenuation of the AP to signal levels appropriate for the confines of the cab space (typically -30 dBm transmit power at AP)
- Channel planning to not interfere with spaces like elevator lobbies and spaces outside the elevator shafts

Standards for Wi-Fi designers

- Need for reasonable standards and certification for Wi-Fi designers with respect to safety and the unique constraints of elevators and stairwells
- Choose from available certifications
 - focus on design, not configuration ability

Summary

- Wi-Fi Enhances security and safety of clinicians and patients both when available in stairwells and elevators
- Codes should be modified to allow properly set up Wi-Fi equipment into these spaces
- Design requirements are different than for normal office spaces, and should have certification requirements of designers
- Trust requires 100% verification after install / configuration

6. Mission Critical Technologies

Facilitator: Peter O'Connor, Hoefer Welker (or designees)

- Illustrate legacy/current definition and approach to “mission critical” systems within codes
- How technologies have evolved to become mission critical by use case
- How current cloud and off-site data centers contribute to the impact and risk related to off-premises data processing and storage
- Define process for identifying systems that should be classified as mission critical
- Example of an impact map that illustrates the downstream impacts of making a system resilient
- Discussion and public input

Mission Critical Technologies

Background

- Currently there are little or no requirements or identified IT systems that need to be in-place to provide “Mission Critical” services.
- “Mission Critical” is loosely defined..
 - **FGI: A2.1-8.5.2.2 (1)** “Provision of a redundant electronic medical record data storage facility should be considered”
 - **FGI: A2.1-8.5.2.2 Technology Equipment Center:** “The TEC houses main networking equipment and the application servers and data storage devices that serve the building”
 - **FGI: A2.1-8.5.2.5 Support for system redundancy:** “Given the requirements for a highly available medical grade network and communication systems, dual redundant, and geographically diverse outside pathways should be provided...”
 - **FGI: 2.1-8.5.3 Emergency Communication System:** “The portable battery-powered radio, ham radio, or other communication systems to be used independently of the building’s service and emergency power systems during emergencies should be determined in the planning phase.”

Scope of Conversation

- **Scenario:**

- A significant event (earthquake, flood, cyber attack) would result in the loss of WAN/service provider connectivity.
- This “extended/multi-system” downtime (i.e., 96 hours) far exceeds most facility’s current downtime procedures and capabilities (single system down for minutes or a few hours).

- **Areas Impacted:**

- Applications:

- EMR
 - Dictation
 - Application Interfaces to EMR
 - Lab Module
 - Pharmacy Module
 - Imaging (3D Processing, VNA, etc.)
 - Med Dispensing
 - ERP
 - CITRIX
 - SSO
 - Office 365 (including collaboration)
 - Bed Management

- Network:

- Call Managers/VoIP (Desk and Mobile)
 - Secure Messaging
 - DNS/DHCP Servers
 - AP Controllers
 - Credentialing
 - File/Print Services

- Systems:


- Clinical Alarm Manager
 - Access Control Database
 - Surveillance Video Analytics
 - Mass Notification
 - P-Tube, BAS, etc.

Legacy/Current Approach

“Develop a strategy”... “Redundant communications can include”... “Should be considered”...

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THIS ITEM APPEARS IN:

[Communications](#)

Redundant Communications


During community catastrophies, regular and cell phone service may be disrupted. Without availability of these services, alternate forms of communication must be relied upon.

It is critical to develop communication strategies which include redundant forms of communication in advance of these events.

Redundant communications can include:


- Basic telephone systems
- In-building wireless phone systems
- Overhead announcement and paging systems
- Nurse call system
- Voice over Internet Protocol systems
- Cell phones
- Beepers and pocket pagers
- Enterprise systems
- BlackBerries and similar devices
- Text messaging
- Text-to-voice translation
- Communication systems for the deaf and hearing impaired

- Telephonic translation lines and services
- Access control systems
- Fax machines
- Hospital television network systems
- E-mail
- Mass notification systems
- Hospital electronic bulletin boards
- Intranet message posting
- Bed-tracking and facility status reporting systems
- Electronic health record systems
- Enterprise systems for networked hospitals
- Resource and grant-asset tracking systems
- Evacuee and disaster patient tracking systems
- Emergency medical services communication systems
- Emergency desktop and mobile handheld programmed radios
- Communication with emergency operations centers
- Public health monitoring and notification systems (syndromic surveillance systems, threat notification systems, outbreak management systems)
- Satellite radio and communication systems
- Ham radio systems
- Human runners (the low-tech communication system if all else fails)

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Evolution in Thinking

- Traditionally, we have identified Mission Critical as a “space” (i.e., Data Center).
- **Our thinking must change...** Mission Critical must be defined at a system level and be determined by Use Case.
- **Recent Project Survey** with 40 users from Surgery, Inpatient Acute Cardiac, Inpatient Acute Cancer and ICU based on the 96-hour scenario:
 - Communications is critical. Any loss of VoIP mobile and desk phones is catastrophic.
 - Use of “Red Phones” today is unrealistic
 - Must have communication (voice and scan/print) with Blood Bank, Lab, and Pharmacy.
 - Need bed management and incident management software on-line.
 - Need ability to notify teams (STEMI, Code, ECMO, Stroke, etc.)

Evolution in Technology

Increased dependence on:

- The EMR and related modules
- VoIP
- Clinical mobility solutions
- Middleware (gateways, app interfaces, clinical alarm managers)
- Digital Dashboards (data aggregation, bed status, etc.)
- Network based UI for complex systems (BAS, Security, etc.)
- More systems requiring servers (nurse call, P-Tube, etc.)
- Higher dependency on digital (PACS image processing, AI, remote collaboration)

Staff don't know how to use "paper" anymore...

Impact, Risk & Mitigation Example

Patient Care/Life Safety/Clinical

Options	System	Purpose	Offline Impact	Assumptions	Estimate
<input checked="" type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Epic (Cadence, clinical and all supporting dept specific (i.e. Radiant, OpTime)) and/or Epic Read Only	Electronic Medical Record, orders, results, AD, case scheduling, etc.	Epic is hosted in off-site data centers. Any loss of internet connectivity would result in complete loss of all EMR related functions, applications and interfaces beyond any local designated read-only computers. Note: The offline data housed in the DR computers will only be valid for a limited period of time.	Create on-prem Epic instance that acts as a 2 nd DR site. This instance mirrors PRD, size based 2/3 (13,000) of overall users (20,000) to cover all shifts. Data synchronization and/or frequency TBD (e.g. every 6 hours)	(15) 1U Nodes
<input checked="" type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Application Interface Engine	Allows clinical/ business applications to interface/sync	No application HL7 data sharing. Inability to sync ADT information	Sequencing of HL7 transactions is critical to ensure data (ADT) information is accurate	(5) 1U Nodes
<input checked="" type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Nuance/ Dragon	Dictation	Loss of server or cloud-based processing	IF using DME, need server/storage, 1 or 2 Nodes, IF using DMO, create local copy to allow DME functionality	(2) 1U Nodes

Impact, Risk & Mitigation Example

Infrastructure

Options	System	Purpose	Offline Impact	Assumption	Estimate
<input type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Network Wired/ wireless	Enablement of data transmission and operations	Architecture can be designed to be isolated and operational enabling the building only connectivity	Suggest Use Rack top Switches 1 VM per application	1 per rack (1) 1U Node
<input type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Identity Management	End user credentialing, access and security	Depending on architecture if cloud enabled or DC user access will be disabled	Need duplicate application VM	Included in GENERAL PURPOSE count above
<input type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Domain Name System	IP logic handling, server, storage, domain access	IP logic handling and server access	Need duplicate application VM	Included in GENERAL PURPOSE count above

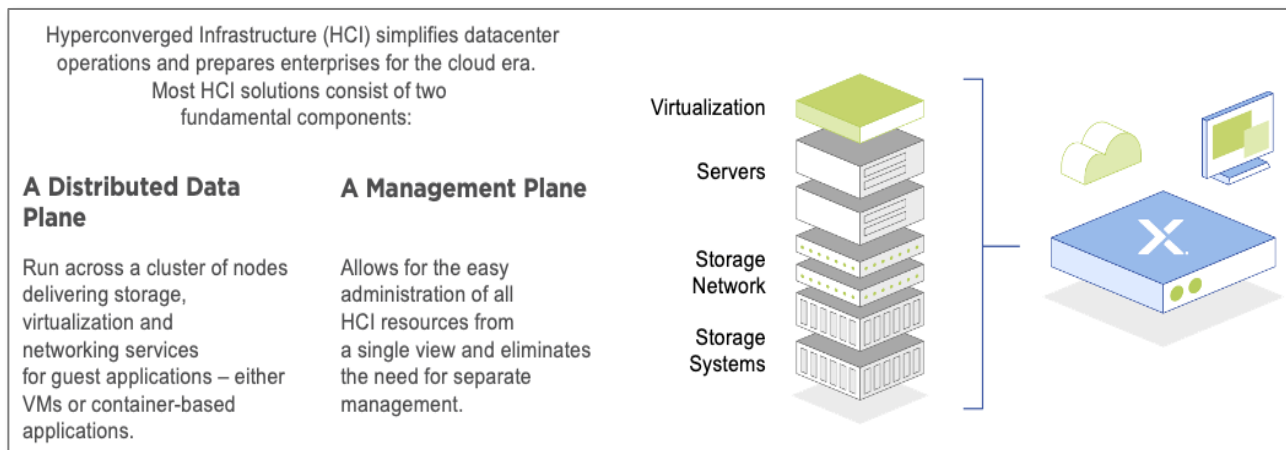
Impact, Risk & Mitigation Example

Public Safety

Options	System	Purpose	Offline Impact	Assumption	Estimate
<input type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Access Control Admin server	Secured Access	No remote lock down capabilities, alerts (door hold open, etc) or changes to user access.	Need duplicate application server	Included in GENERAL PURPOSE count above
<input type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Security Cameras Admin servers	Surveillance	Loss of PTZ control, access to camera feeds, loss of network video recording	Need duplicate application servers	(1) 1U Node
<input type="checkbox"/> Expected to be off-line. Use Downtime Procedure <input type="checkbox"/> Expected to be online but not hosted in the building. <input type="checkbox"/> Expected to be online and hosted in the building.	Critical Event Notification	Mass notification	A mass notification system such as Everbridge is likely cloud based. Loss of internet without local instance and/or alternate emergency configurations could result in complete loss of emergency mass notification capability.	Need to create local copy or use other tools. Strategy to include: Epic Inbasket, wireless phones, overhead paging, and preprogrammed offsite alert	(1) 1U Node

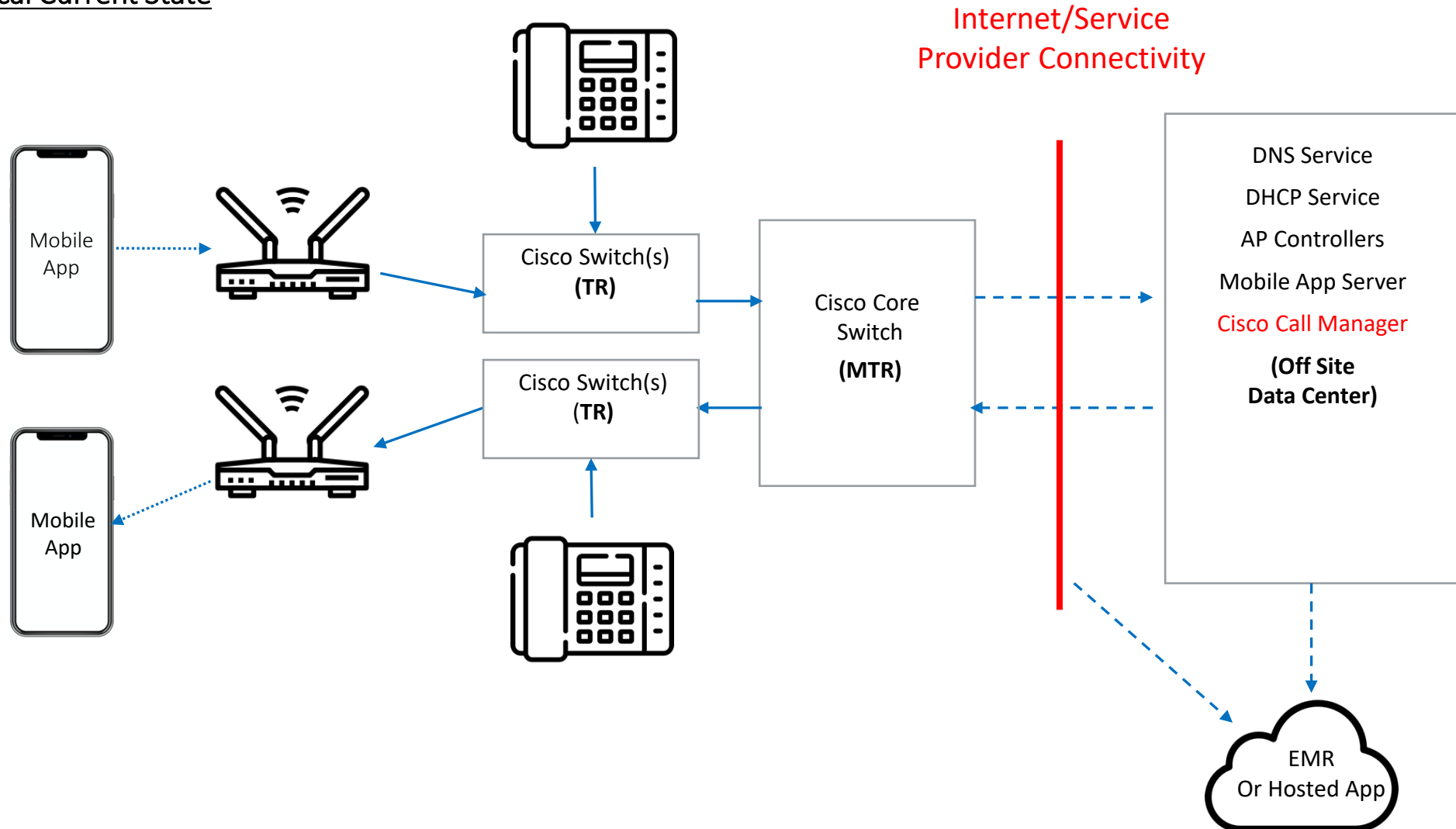
Considerations

- Requires a dedicated Mission Critical space (and related power and cooling) which is not in the typical program
- Requires a deep dive into current applications and locations (under a desk, basement, random IDF) of critical components (servers, etc.)
- May require re-architecture and re-location of existing systems
- Could be 10 – 20 Racks based on identified application hosting and server/storage infrastructure approach (traditional vs. hyperconverged)
- Example of hyperconverged infrastructure:



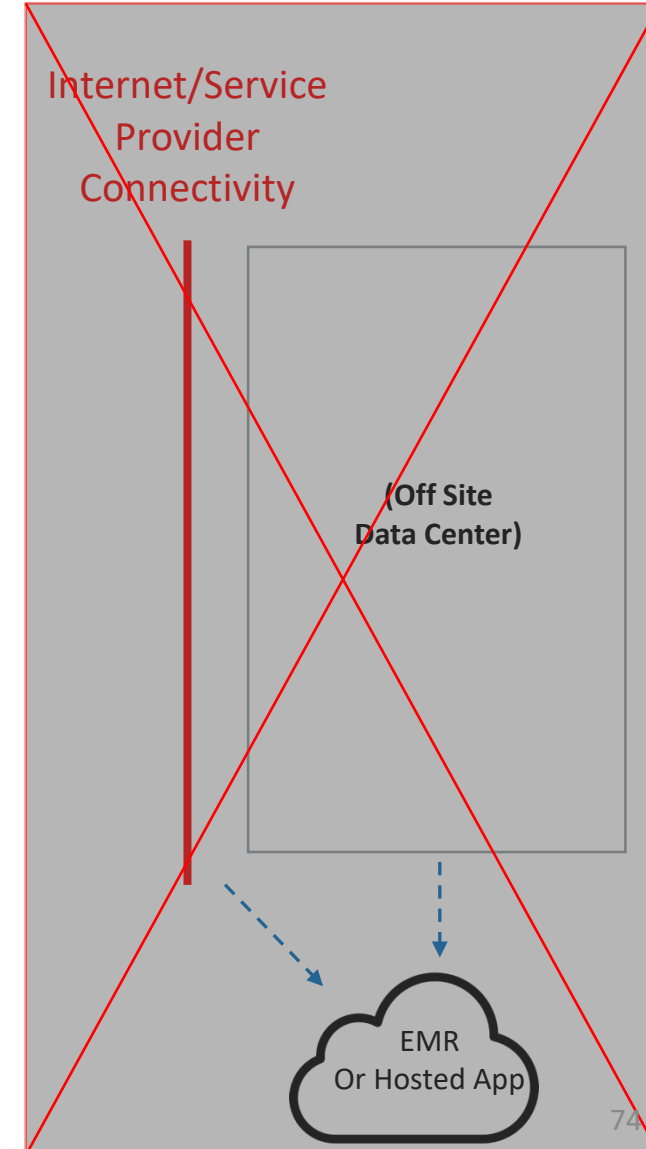
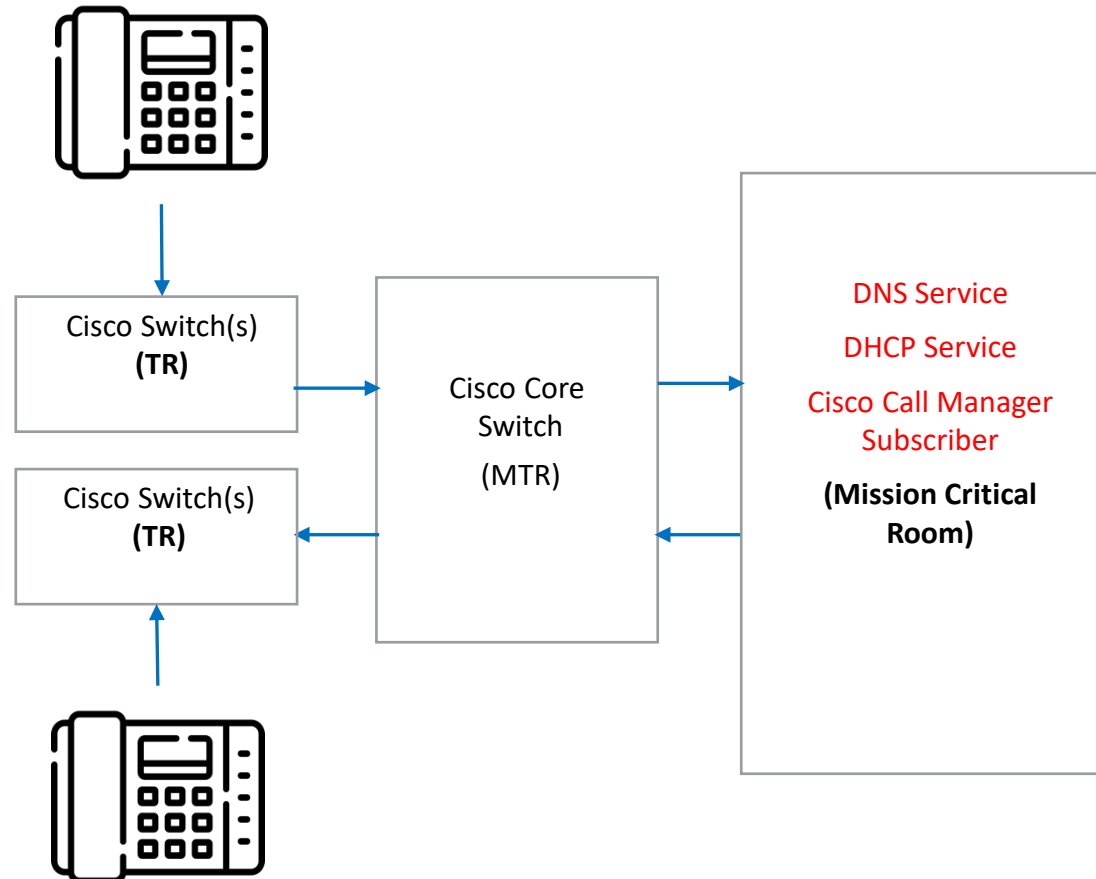
Impact Maps

Typical Current State



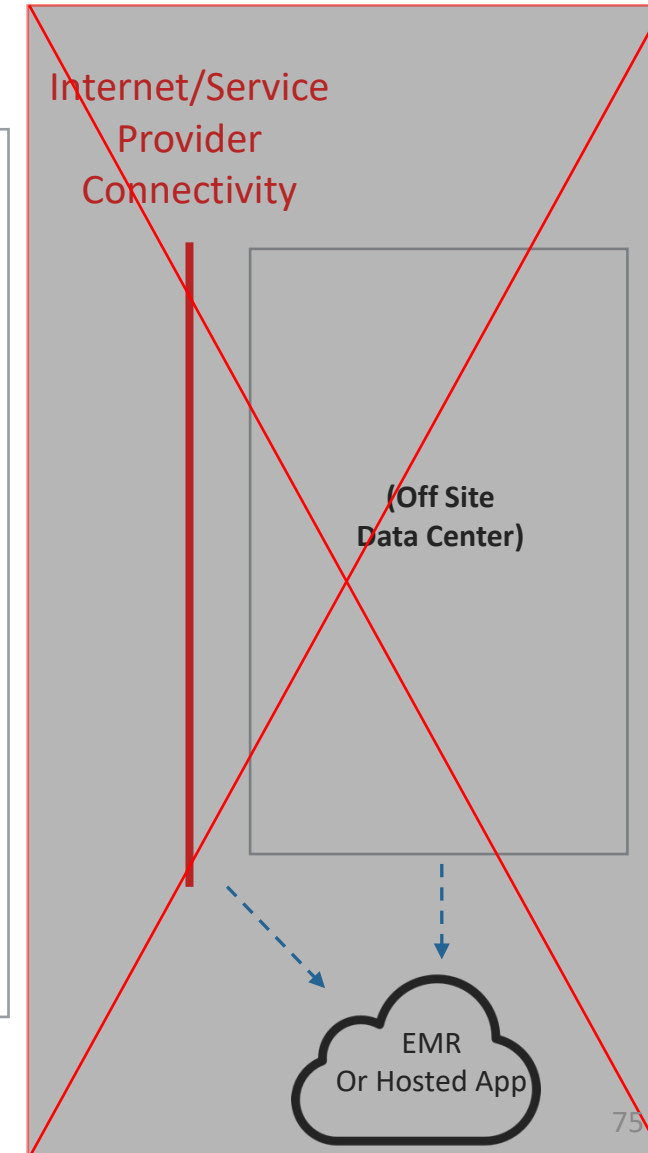
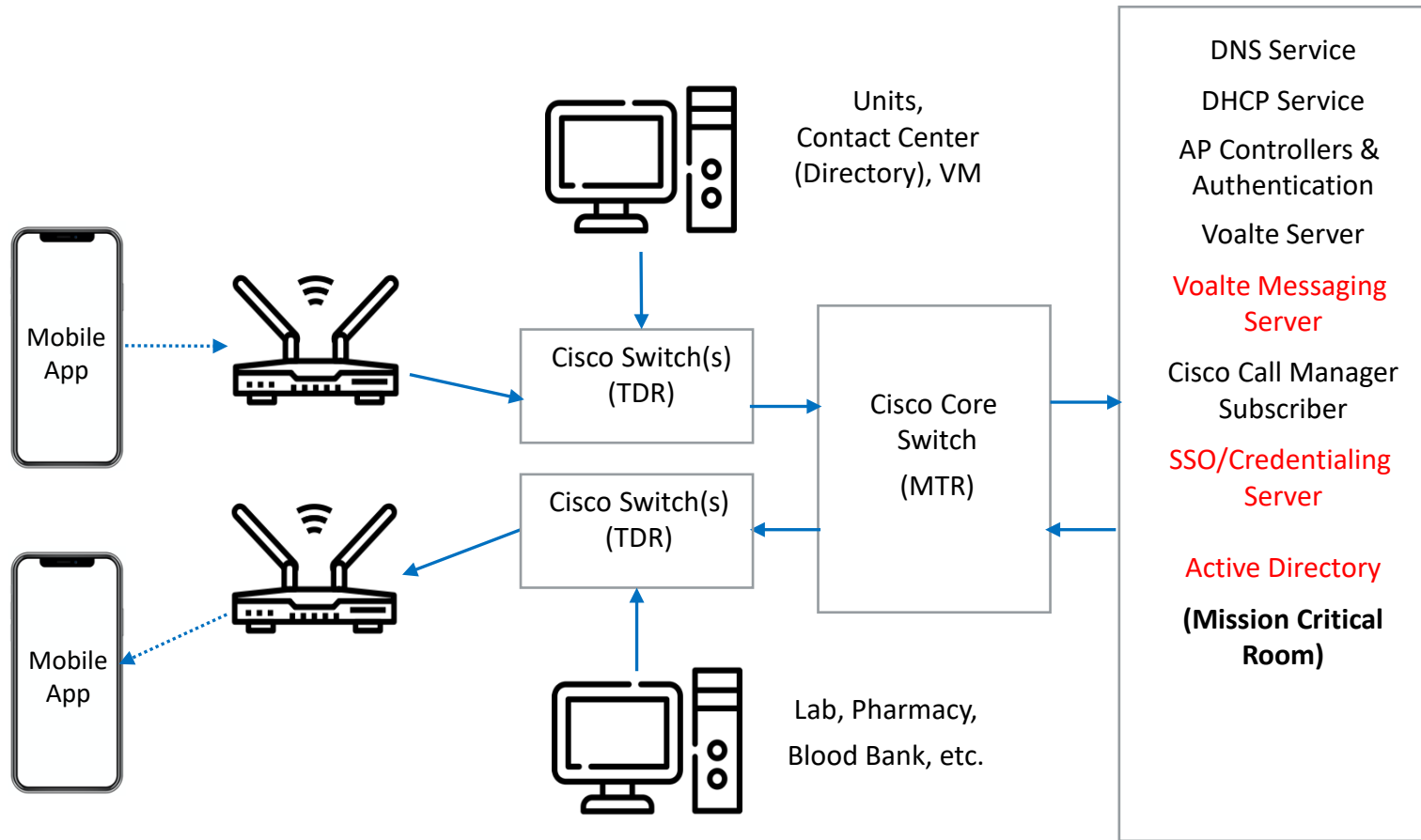
Impact Maps

Mission Critical: (IP Desk Phones Only)



Impact Maps

Mission Critical: Text Messaging

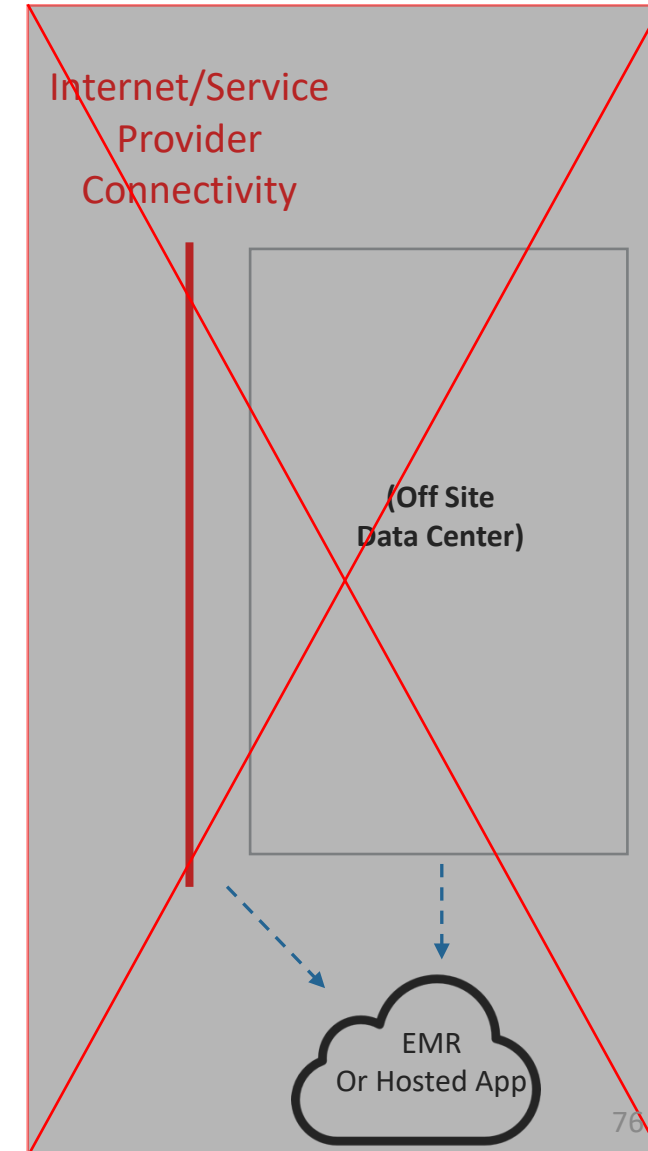



HOEFER WELKER

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graph LR; NurseCall[Nurse Call] --> TDR1[Cisco Switch(s) (TDR)]; PTMonitoring[PT Monitoring] --> TDR1; TDR1 <--> TDR2[Cisco Switch(s) (TDR)]; TDR1 <--> MTR[Cisco Core Switch (MTR)]; TDR2 <--> MTR; MTR --> Services[DNS Service, DHCP Service, AP Controllers & Authentication, Voalte Server, Voalte Messaging Server, Cisco Call Manager Subscriber, SSO/Credentialing Service, Active Directory, Nurse Call Gateway]; MTR --> GE[GE Gateway]; MTR --> CAMS[Clinical Alarm Manager Server]; MTR --> MCR[Mission Critical Room]; MobileApp[Mobile App] -.-> Router[Wireless Router]; Router --> TDR1;
```

The diagram illustrates the network architecture for a Mission Critical Room. It shows the flow of data from external services and internal monitoring to the core network and finally to the room's critical systems. The components include:

- External Services:** DNS Service, DHCP Service, AP Controllers & Authentication, Voalte Server, Voalte Messaging Server, Cisco Call Manager Subscriber, SSO/Credentialing Service, Active Directory, Nurse Call Gateway, GE Gateway, Clinical Alarm Manager Server.
- Internal Monitoring:** PT Monitoring, Nurse Call.
- Network Core:** Cisco Core Switch (MTR), Cisco Switch(s) (TDR).
- Client/Endpoint:** Mobile App, Wireless Router.
- Room Environment:** Mission Critical Room.



Discussion

7. Comments from the Public/Committee Members on issues not on this agenda

Facilitator: Bruce Rainey, Committee Chair (or designee)

The Committee will receive comments from the Public/Committee Members. Matters raised at this time may be taken under consideration for placement on a subsequent agenda.